

DEPARTMENT OF COMMERCE AND LABOR

U.S. BUREAU OF THE CENSUS
" " " " " "

S. N. D. NORTH, DIRECTOR

SPECIAL REPORTS

TELEPHONES AND TELEGRAPHS

1902



*Bureau of the Census
Library*

WASHINGTON
GOVERNMENT PRINTING OFFICE

1906

CONTENTS.

	Page.
Letter of transmittal.....	xi
PART I.	
TELEPHONES.	
CHAPTER I.	
GENERAL STATISTICS.	
Introduction.....	3
General statistics for telephone and telegraph systems.....	3
Dominance of telephony.....	4
CHAPTER II.	
GENERAL TELEPHONE STATISTICS.	
Comparative summary.....	5
Summary of systems in outlying districts.....	5
Classification of systems.....	6
Statistics for systems, by class.....	7
Statistics by geographic divisions.....	8
Rural lines.....	11
CHAPTER III.	
TELEPHONE CAPITALIZATION.	
Capitalization of incorporated companies.....	12
Capitalization of commercial systems.....	12
Capitalization of mutual systems.....	13
Capitalization of Bell and independent systems.....	13
Assets and liabilities.....	14
Balance sheet for commercial systems.....	15
Balance sheet for mutual systems.....	15
CHAPTER IV.	
REVENUE AND EXPENSES.	
Revenue.....	16
Operating expenses.....	16
Outlay for new construction.....	16
Division of net earnings.....	17
Returns for Bell systems.....	18
Revenue and expenses of large systems.....	18
Revenue and expenses, by states.....	18
Revenue and expenses of commercial systems.....	19
Revenue and expenses of mutual systems.....	19
CHAPTER V.	
TELEPHONE TRAFFIC.	
Nature of traffic.....	21
Definition of message.....	21
Traffic statistics.....	21
Distribution of telephone stations.....	22
Traffic, by geographic divisions.....	22
Traffic, by states and territories.....	23

	Page.
Traffic of commercial and mutual systems.....	23
Relation between telephones, messages, and population.....	26
Telephones in urban centers.....	26
Rates.....	27
Traffic per subscriber and instrument.....	28
Relation of traffic to earnings and expenses.....	29
Other factors of traffic.....	30
Traffic records.....	30
 CHAPTER VI. APPARATUS OF THE SUBSTATION. 	
Physical equipment.....	33
Statistics of substations.....	33
Rural substations.....	33
Private stations and pay stations.....	35
Classification of private stations.....	35
Classification of pay stations.....	35
Party line stations.....	36
Magneto and common battery stations.....	36
Magneto substation apparatus.....	36
Series and bridged substations.....	36
Common battery apparatus.....	37
Substation receivers.....	37
Substation transmitters.....	37
The induction coil.....	38
Signaling apparatus.....	38
Protection of substation.....	38
Automatic stations.....	39
 CHAPTER VII. THE WIRE PLANT. 	
Governing conditions.....	40
Statistics of wire circuits.....	40
Wire mileage, by geographic divisions.....	40
Wire mileage of rural lines.....	40
Underground, overhead, and submarine wires.....	40
Miles of wire per system and station.....	41
Kind of poles used.....	41
Telephone cables.....	42
Telephone conduits.....	43
 CHAPTER VIII. CENTRAL OFFICE OR EXCHANGE. 	
Definition of central office.....	44
Telephone switchboards.....	44
Statistics of switchboard equipment.....	44
Geographic distribution of exchanges and switchboards.....	45
Capacity of exchange and switchboard.....	45
Miscellaneous central office equipment.....	45
Method of central office connection.....	46
The complete switchboard.....	46
Lamp signal switchboards.....	47
The distributing board.....	47
The common battery equipment.....	47
Common battery switchboard circuits.....	48
Toll line switchboards.....	48
 CHAPTER IX. EMPLOYEES, SALARIES, AND WAGES. 	
General statistics.....	49
Statistics of employees and wages for all systems.....	49
Statistics for principal states.....	50
Statistics of commercial systems.....	50
Statistics of mutual systems.....	50
The welfare of telephone operators.....	50

CONTENTS.

v

CHAPTER X.

DEVELOPMENT OF THE MESSAGE RATE PLAN IN NEW YORK CITY.

	Page.
Early service and rates.....	52
Metallic circuit introduced.....	53
First message rates.....	53
Features of message rate plan.....	54
Reductions in message rate schedules.....	54
Rates in local areas—borough of the Bronx.....	54
Residence rates.....	55
Private branch exchange service and rates.....	55
Pay stations.....	56
Rates in Brooklyn, Queens, and Richmond boroughs.....	56
Present conditions and growth since adoption of message rate.....	57

CHAPTER XI.

HISTORY AND DEVELOPMENT OF TELEPHONY.

Early development.....	63
The work of Bell.....	64
First commercial telephony.....	65
Early telephone competition.....	66
Independent development.....	67

CHAPTER XII.

TELEPHONY IN FOREIGN COUNTRIES.

General data.....	68
Germany.....	69
Austria.....	69
Belgium.....	70
Holland.....	70
Denmark.....	70
Spain.....	70
Italy.....	71
Russia.....	71
France.....	71
Switzerland.....	71
Norway.....	72
Sweden.....	73
Great Britain and Ireland.....	73
British India.....	75
Canada.....	75
Japan.....	75
Telephone rates.....	75
Telephonic telegrams.....	78

PART II.

TELEGRAPHS.

CHAPTER I.

TELEGRAPH AND CABLE SYSTEMS.

General statistics.....	99
Chief features of the data.....	100
Comparison with the telephone.....	100
Comparative data—earnings and expenses.....	100
Salaries and wages.....	102
Wire mileage.....	102
Telegraph power plants.....	102
Methods of telegraphic operation.....	103
Press messages.....	103
District messenger system.....	103
The stock quotation service.....	104
Commercial telegraphs on steam railroads.....	104
Railway telegraphs and telephones.....	104

CONTENTS.

CHAPTER II.

GOVERNMENTAL TELEGRAPH AND TELEPHONE SERVICE.

	Page.
United States Signal Corps.....	106
The Signal Corps in the Philippines.....	106
Alaskan telegraphs.....	107
United States cable ships.....	108
Other telegraphic work of the Signal Corps.....	109
Telegraphy in the Weather Bureau.....	109
United States Life-Saving Service.....	110

CHAPTER III.

HISTORY AND DEVELOPMENT OF TELEGRAPHY.

Pioneers of telegraphy.....	111
Commercial developments.....	114
Submarine telegraphs.....	116
Submarine cables.....	116
Submarine signaling.....	118
Wireless telegraphy.....	118

PART III.

MUNICIPAL ELECTRIC FIRE ALARM AND POLICE PATROL SYSTEMS.

Electric fire alarm systems.....	123
Historical and descriptive.....	134
Electric police patrol systems.....	139
Historical and descriptive.....	146
Special features.....	148

LIST OF TABLES.

TELEPHONES.

Table 1.—Comparative summary—telephone and telegraph systems, including submarine cable systems: 1902.....	4
Table 2.—Comparative summary—all telephone systems: 1902, 1890, and 1880.....	5
Table 3.—Summary—outlying districts: 1902.....	6
Table 4.—Number of systems and independent rural lines, miles of wire, and number of telephones: 1902.....	7
Table 5.—Summary—all systems: 1902.....	7
Table 6.—Summary—Bell and independent systems: 1902.....	7
Table 7.—All systems—telephones, messages, and population, with percentages and averages, by geographic divisions: 1902.....	8
Table 8.—All systems—summary by geographic divisions: 1902.....	8
Table 9.—Commercial systems—summary by geographic divisions: 1902.....	8
Table 10.—Distribution of existing independent commercial systems according to year in which established, by states and territories: 1883 to 1902.....	9
Table 11.—Mutual systems—summary by geographic divisions: 1902.....	10
Table 12.—Distribution of existing mutual systems according to year in which established, by states and territories: 1881 to 1902.....	10
Table 13.—Number of rural lines, classified as commercial, mutual, and independent rural, with the wire mileage, and the number of telephones, by geographic divisions: 1902.....	11
Table 14.—Capitalization of incorporated companies—all systems: 1902.....	12
Table 15.—Capitalization of the American Telephone and Telegraph Company and its licensee companies: 1902.....	13
Table 16.—Capitalization of incorporated companies—Bell and independent systems: 1902.....	14
Table 17.—Balance sheet for all systems and for commercial and mutual systems: 1902.....	14
Table 18.—All systems—income account: 1902.....	16
Table 19.—All systems—analysis of operating expenses: 1902.....	16
Table 20.—All systems—cost of additional construction, by states and territories: 1902.....	17
Table 21.—Revenue and expenses of all systems and of systems having 1,000 telephones and over: 1902.....	18
Table 22.—Commercial systems—income account: 1902.....	19
Table 23.—Commercial systems—analysis of operating expenses: 1902.....	19
Table 24.—Mutual systems—income account: 1902.....	19
Table 25.—Mutual systems—analysis of operating expenses: 1902.....	20
Table 26.—All systems—average population per telephone station, by geographic divisions: 1902.....	22
Table 27.—Messages—commercial and mutual systems, by geographic divisions: 1902.....	23
Table 28.—All systems—average number of local and of long distance and toll messages per telephone, by geographic divisions: 1902.....	23
Table 29.—Commercial systems—analysis of physical equipment and messages, by states and territories: 1902.....	24
Table 30.—Mutual systems—analysis of physical equipment and messages, by states and territories: 1902.....	25

CONTENTS.

vii

	Page.
Table 31.—All systems—telephones, messages, and population, by states and territories: 1902.....	26
Table 32.—Estimated population, number of telephones, and average population per telephone for the largest fourteen cities: 1902.....	27
Table 33.—Summary—urban and rural commercial systems: 1902.....	27
Table 34.—Messages per subscriber and per telephone: 1902.....	28
Table 35.—Traffic comparison, Bell and independent systems: 1902.....	29
Table 36.—All systems—average revenue and operating expenses per telephone and per message, by states and territories: 1902.....	29
Table 37.—Summary—all systems, physical equipment: 1902.....	33
Table 38.—Number of rural lines, classified as commercial, mutual, and independent rural, with the wire mileage and the number of tele- phones, by states and territories: 1902.....	34
Table 39.—Number of rural lines, with the wire mileage and the number of telephones, for the five leading states: 1902.....	35
Table 40.—Number of public exchanges, Bell and independent systems, by states and territories: 1902.....	45
Table 41.—Telephone development, United States and Europe.....	68
Table 42.—Telephone development in large cities.....	68
Table 43.—All telephone systems—summary, by states and territories: 1902.....	80
Table 44.—All telephone systems—revenue and expenses, by states and territories: 1902.....	82
Table 45.—All telephone systems—employees, salaries, and wages, by states and territories: 1902.....	84
Table 46.—All telephone systems—exchanges, stations, and line construction, by states and territories: 1902.....	86
Table 47.—All telephone systems—telephone switchboards, power plants, and batteries, by states and territories: 1902.....	88
Table 48.—Commercial telephone systems—summary, by states and territories: 1902.....	90
Table 49.—Commercial telephone systems—revenue and expenses, by states and territories: 1902.....	92
Table 50.—Mutual telephone systems—summary, by states and territories: 1902.....	94
Table 51.—Mutual telephone systems—revenue and expenses, by states and territories: 1902.....	95

TELEGRAPHS.

Table 1.—Commercial systems—comparative summary: 1902 and 1880.....	99
Table 2.—Capitalization of incorporated companies: 1902.....	101
Table 3.—Commercial systems—income account: 1902.....	101
Table 4.—Commercial systems—operating expenses: 1902.....	101
Table 5.—Commercial systems—balance sheet: 1902.....	101
Table 6.—Commercial systems—employees, salaries, and wages: 1902.....	102
Table 7.—Commercial systems—line construction: 1902.....	102
Table 8.—Commercial systems—generating plants in offices: 1902.....	102
Table 9.—Commercial systems—miles of wire owned or leased, distributed according to method of operation: 1902.....	103
Table 10.—Railway telegraphs and telephones—summary: 1902.....	104

MUNICIPAL ELECTRIC FIRE ALARM AND POLICE PATROL SYSTEMS.

Table 1.—Electric fire alarm systems, grouped according to boards or departments of administration: 1902.....	123
Table 2.—Electric fire alarm systems installed each year.....	124
Table 3.—Electric fire alarm systems, grouped according to population of cities, and the percentage each item is of total: 1902.....	124
Table 4.—Electric fire alarm systems reporting different varieties of construction and equipment, grouped according to population of cities: 1902.....	126
Table 5.—Underground construction of electric fire alarm systems, by states and cities: 1902.....	127
Table 6.—Employees and wages in cities of 100,000 population and over, electric fire alarm and police patrol systems: 1902.....	128
Table 7.—Electric fire alarm systems, by states: 1902.....	130
Table 8.—Electric fire alarm and police patrol systems of Honolulu, Hawaii: 1902.....	132
Table 9.—Electric fire alarm and police patrol systems having perpetual right of way on poles or in conduits, without cost to the city, grouped according to population of cities: 1902.....	133
Table 10.—Construction and equipment of electric systems used interchangeably for fire alarm and police patrol, grouped according to popu- lation of cities: 1902.....	133
Table 11.—Electric police patrol systems, grouped according to boards or departments of administration: 1902.....	139
Table 12.—Electric police patrol systems installed each year.....	139
Table 13.—Electric police patrol systems, grouped according to population of cities, and percent age each item is of total: 1902.....	140
Table 14.—Electric police patrol systems reporting different varieties of construction and equipment, grouped according to population of cities: 1902.....	141
Table 15.—Underground construction of electric police patrol systems, by states and cities: 1902.....	142
Table 16.—Electric police patrol systems, by states: 1902.....	144

APPENDICES.

Appendix A.—Schedules.....	153
Appendix B.—Instructions to special agents.....	161

LIST OF ILLUSTRATIONS.

	Facing page.
A magneto substation.....	22
Subscriber set, bridging system lines, local battery.....	26
Subscriber set, common battery or central energy system.....	26
Cabinet set transmitter.....	28
Bipolar receiver.....	28
Telephone receiver.....	30
Section of receiver.....	30
Receiver dissected.....	30
Desk set, receiver and transmitter.....	30
Transmitter head.....	34
Section of transmitter.....	34
Rear view of assembled transmitter, case removed.....	34
Lightning arrester.....	36
Combined fuse and lightning arrester.....	36
Magneto bell.....	36
Magneto generator assembled.....	36
Magneto generator dissected.....	36
Automatic telephone desk set, subscriber's station.....	38
Automatic telephone wall set, subscriber's station.....	38
Automatic telephone wall set, showing party calling.....	38
Automatic telephone switch, central station.....	38
Telephone conduits near street railway track.....	42
Group of twenty-four ducts in telephone conduit showing standard practice.....	42
Central automatic exchange, Grand Rapids, Mich., 6,000 line full automatic.....	44
Main exchange, Pittsburg, Pa., before occupancy by operators.....	44
Small magneto switchboard.....	46
Rear view of magneto switchboard.....	46
Early telephone exchange in New York city.....	46
One wing of telephone exchange, Cortlandt street, New York city, with operators at positions.....	48
Telephone central offices and central office districts in New York city, January 1, 1894.....	61
Telephone central offices and central office districts in New York city, January 1, 1905.....	62
A main operating telegraph room.....	112
Automatic repeater equipment in telegraph operating room.....	112
New fast stock ticker.....	114
Typewriting telegraph system.....	114
Types of submarine cables.....	117
Telegraph department, fire alarm headquarters, Washington, D. C.: 1902.....	128

DIAGRAMS.

	Page.
1.—Telephone calls by hours, business center, residence district, and outskirts of a large city: 1902.....	31
2.—Telephone calls per line in the three districts of a large city, shown by hours in Diagram 1: 1902.....	31
3.—Telephone calls by hours, main and branch offices, in city of medium size: 1902.....	32
4.—Telephone calls by hours in a manufacturing city having a population of about 100,000: 1902.....	32
5.—Telephone calls by hours in a village having a population of about 2,000: 1902.....	32

LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF THE CENSUS,
Washington, D. C., January 23, 1906.

SIR:

I have the honor to transmit herewith a report on the telephone and telegraph systems and the municipal electric fire alarm and police patrol systems of the United States. This report was prepared in accordance with the provisions of section 7 of the act of Congress of March 6, 1902. The statistics cover the calendar year ending December 31, 1902, and were collected and compiled under the supervision of Mr. W. M. Steuart, chief statistician for manufactures. The text has been prepared by Mr. Thomas Commerford Martin, of New York city, expert special agent, with the cooperation and criticism of Mr. A. V. Abbott, as to the telephone portion, and Mr. W. Maver, jr., as to the telegraph portion.

The report presents statistics concerning the physical equipment, service, and financial operations of the commercial and mutual telephone and telegraph systems of the country and the physical equipment of independent rural telephone lines. It also gives data relative to the systems controlled in whole or in part by railway companies, and the ocean cable systems that were in operation all or part of the year.

This is the last of a series of reports on the generation and utilization of electric current. Former reports relate to street and electric railways and central electric light and power plants. The statistics for the telephone and telegraph systems were published on December 15, 1904, as Bulletin 17 of the Bureau of the Census, and those for municipal electric fire alarm and police patrol systems on May 31, 1904, as Bulletin 11.

With the publication of this report the Bureau of the Census closes the first complete census of the generation and utilization of electric current for the transmission of power, messages, and conversation. These industries are of such vast importance, have undergone such rapid changes, and have advanced during the past decade to such an extent that, in order to convey a correct idea of their development, the census should be taken at more frequent intervals than decennially, as required by the present law.

The telephone and telegraph companies have uniformly treated the request of this office for statistical information with the utmost courtesy and consideration. They have freely furnished information of a confidential character concerning their financial operations, and have manifested a willingness to assist in the compilation of reliable statistics, which has been gratifying to all engaged in the work. Some companies have incurred large expense for clerical assistance to compile the data, and have furnished the office with every facility for making a complete report. Unfortunately the account books of some of the smaller companies and mutual systems were so incomplete that accurate answers could not be given to all of the Census inquiries.

Very respectfully,



Director.

Hon. VICTOR H. METCALF,
Secretary of Commerce and Labor.